Nasal Substitution in Pendau: an Optimality Theoretic Approach

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Overview of the presentation

• Nasal substitution in Pendau and correspondence-OT analysis

• Phonological Opacity:
  o Opacity #1: /ŋs/ > [ŋ] or [ŋ̪s]
  o Opacity #2: /ŋʔ/ > [ŋk] but not [ŋ]

• Conclusion
Background of Pendau

- Austronesian language spoken in central Sulawesi, Indonesia.
- Endangered; about 4000 native speakers (Lewis 2009)
- The only existing grammar: A Grammar of the Pendau Language of Central Sulawesi, Indonesia (Quick 2007)
• The replacement of a root-initial voiceless obstruent by a homorganic nasal under prefixation
  ○ e.g. Indonesian (Pater 2001)
    • /məŋ-paksa/ > [məmaksə] ‘to force’

• Nasal substitution in Pendau
  ○ /moŋ-paresa/ > [momaresa] ‘to check’
  ○ /moŋ-tuda/ > [monũda] ‘to plant’
  ○ /moŋ-ketik/ > [monetik] ‘to type’
    • /moŋ-/: active voice irrealis
  ○ However, there are exceptions.
Previous OT analysis

• Pater (1995, 2001): nasal substitution is fusion of the nasal and the voiceless consonant; it avoids ‘false step’ of voiceless obstruent deletion.
  
  o In correspondence-OT, this is a violation of Uniformity (No element of output has multiple correspondents in input).

  Input: $N_1 C_2$

  Output: $N_{12}$

• Pater (2001): CrispEdge\[prwd\] forbids NC sequence in the output.
Previous OT analysis

- CrispEdge[prwd] requires ALIGN-WD
  Align (Root, Left; PrWd, Left): ‘The left edge of each root coincides with the left edge of some PrWd’
- Evidence comes from stress assignment from Indonesian (Cohn and McCarthy 1994).
- Prefixes are outside the domain of stress assignment.

<table>
<thead>
<tr>
<th>With prefix di-</th>
<th>Without prefixes</th>
</tr>
</thead>
<tbody>
<tr>
<td>di-(cát)</td>
<td>‘printed’</td>
</tr>
<tr>
<td>(dídidík)</td>
<td>‘educate’</td>
</tr>
<tr>
<td>di-ko(réksi)</td>
<td>‘corrected’</td>
</tr>
<tr>
<td>(bijak)(sána)</td>
<td>‘wise’</td>
</tr>
<tr>
<td>di-(próvo)(kási)</td>
<td>‘provoked’</td>
</tr>
<tr>
<td>(kònti)nu(ási)</td>
<td>‘continuation’</td>
</tr>
<tr>
<td>di-(ánti)si(pási)</td>
<td>‘anticipated’</td>
</tr>
<tr>
<td>(òto)(bìo)(gráfi)</td>
<td>‘autobiography’</td>
</tr>
</tbody>
</table>
Nasal substitution in Pendau

• Pendau provides additional support for the fusion approach.
• There is (blocking of) vowel harmony when verbs are prefixed.

<table>
<thead>
<tr>
<th>V-initial root (e.g. /inuŋ/; /uraŋ/)</th>
<th>C-initial root (e.g. /pareśa/; /baṣa/)</th>
</tr>
</thead>
<tbody>
<tr>
<td>V-final prefix (e.g. rV-)</td>
<td>reinuŋ; rouraς</td>
</tr>
<tr>
<td></td>
<td>rapareśa; rabasa</td>
</tr>
<tr>
<td>C-final prefix (e.g. moŋ-)</td>
<td>meniŋuŋ; moŋuras</td>
</tr>
<tr>
<td></td>
<td>momaresa; mombaṣa</td>
</tr>
</tbody>
</table>

• Vowel harmony is blocked when there is an NC sequence or a coalesced nasal between the vowels.
• [moṃaresa]: that the intervocalic nasal acts like a cluster, blocking vowel harmony.
• The output nasal corresponds to two input segments.
  Input: \[ \eta_1 p_2 \] \hspace{1cm} \text{cf.} \hspace{1cm} \eta_1 b_2
  \[ \begin{array}{c}
    \text{V} \\
    | | \\
  \end{array} \]
  Output: \[ m_{12} \] \hspace{1cm} m_1 b_2
• The nasal may be ambisyllabic. The coda of the first syllable blocks vowel harmony. (Languages like Yucatec Maya (Krämer 2001) and Assamese (Mahanta 2008) have the same pattern).
Nasal substitution in Pendau

- Pendau does not exhibit phenomena showing that the left edge of a root coincides with the left edge of a Prosodic Word.
- Stress in Pendau only falls on the penultimate syllables, and there is no secondary stress.
- I adopt *CC, which is a more general constraint and makes no reference to higher prosodic structure.
  - *CC >> Uniformity
- Assimilation is regressive. The place feature of the root onset is not changed, whereas that of the prefix coda is.
  - /ŋŋ/ > [m], *[ŋ]
- IdentPlaceOnset, *CC >> Uniformity

<table>
<thead>
<tr>
<th>/moŋ₁-p₂areṣa/</th>
<th>*CC</th>
<th>UNIF</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. mom₁p₂areṣa</td>
<td>*!</td>
<td></td>
</tr>
<tr>
<td>b. mom₁p₂areṣa</td>
<td>*!</td>
<td></td>
</tr>
<tr>
<td>c. mom₁₂areṣa</td>
<td></td>
<td>*</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>/moŋ₁-p₂areṣa/</th>
<th>IDENTPLACEON</th>
<th>*CC</th>
<th>UNIF</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. mom₁₂areṣa</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. moŋ₁₂areṣa</td>
<td>*!</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Opacity #1: /ŋs/ > [ŋs] or [n]

- Nasal substitution in Pendau is sometimes observed when the postnasal obstruent is a fricative.
- /moŋ-ɔmba[e]/ > [moŋamba[e] ‘to butcher’; the resulting output is not [ŋ] as we would expect.
- A nasal-fricative sequence is also observed in some words.
  - /moŋ-ɔ[e]/ > [moŋsɔ[e] ‘to fry’
- Is [ŋs] a pre-nasalized fricative?
  - There is only one instance of reduplication that suggests that [ŋs] may be a pre-nasalized fricative: the reduplicated form of the verb [moŋsa[e] (</moŋ-sa[e]/) is [moŋsa[ŋs]sa[e] ‘persuade and persuade’, with both [ŋ] and [s] in the reduplicant-initial position, but [ŋ] could be syllabified as the coda of the preceding syllable.
  - NC sequences in word-initial positions are heterosyllabic, with the nasals being syllabic (Quick 2007).
  - ‘The phoneme /s/ does not delete in all lexical words, and in some words it appears to be optionally deleted. When the /s/ is not deleted the preceding nasal becomes the dental /n/’ (Quick 2007: 66, fn1).
Opacity #1: /ŋs/ > [ŋs] or [n]

- Assuming [n̪s] is an NC sequence, /ŋs/ > [n̪s] is a violation of *CC
- Nasals and fricatives have different continuancy features.

\[
\begin{align*}
N_{12} & \quad [-\text{continuant}] \\
N_{1} & \quad [-\text{continuant}] \quad S_{2} & \quad [+\text{continuant}] \\
\end{align*}
\]

- Nasal substitution is a violation of Ident[cont]: Output correspondent of an input [α continuant] is also [α continuant].
- NasAssim, IdentPlaceOnset, Ident[cont]>> *CC
- The fully faithful candidate [n̪s] does not violate Ident[cont], but violates NasAssim.

<table>
<thead>
<tr>
<th>/mɒn̪1-səlɛ/</th>
<th>NasAssim</th>
<th>IdentPlaceOnset</th>
<th>Ident[cont]</th>
<th>*CC</th>
<th>Unif</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. mon̪səlɛ</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>b. mon̪səlɛ</td>
<td>*!</td>
<td>✔</td>
<td>✔</td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>c. mon̪səlɛ</td>
<td>✔</td>
<td>✔</td>
<td>*!</td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>d. mon̪səlɛ</td>
<td>*!</td>
<td>✔</td>
<td>*</td>
<td>*</td>
<td></td>
</tr>
</tbody>
</table>
Opacity #1: /ŋs/ > [ŋs] or [ŋ]

- /moŋ-šamba[e]/ > [moɲamba[e] ‘to butcher’: there is nasal substitution but the nasal is palatal, so it suggests the fricative is palatal phonologically, i.e., /ʃ/ (Cf. Javanese (Mester 1986), Indonesian (Pater 2001) and Lauje (Himmelmann 2005)).
- This palatal fricative never surfaces (even in roots), indicating that there is a constraint forbidding it in outputs.
- *[-Son, Pal]: Palatal obstruents are prohibited.
- *[-Son, Pal], IdentPlaceOnset >> Ident[Cont]
  - /ŋ₁s₂/ > [ŋ₁2] is a violation of Ident[Cont], but it satisfies *[-Son, Pal].

<table>
<thead>
<tr>
<th>/moŋ₁-ʃ₂ambale/</th>
<th>NAS ASSIM</th>
<th>*[-SON, PAL]</th>
<th>IDENT PLACE ON</th>
<th>IDENT [CONT]</th>
<th>*CC</th>
<th>UNIF</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. mon₁₂ambale</td>
<td></td>
<td></td>
<td></td>
<td>*</td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>b. mon₁₂ambale</td>
<td></td>
<td></td>
<td>*!</td>
<td>*</td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>c. mon₁ʃ₂ambale</td>
<td></td>
<td>*!</td>
<td></td>
<td></td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>d. mon₁ʃ₂ambale</td>
<td></td>
<td>*!</td>
<td></td>
<td></td>
<td></td>
<td>*</td>
</tr>
</tbody>
</table>
Opacity issue #2: /ŋʔ/ > [ŋk]

- /ʔ/ is a phoneme in Pendau.
  - Minimal pairs: e.g. /ʔapi/ ‘wing’
    /api/ ‘fire’

- While the output of the input /ŋk/ at the prefix-root boundary is [ŋ], the output of the input /ŋʔ/ is [ŋk]
  - /moŋ-keʔik/ > moŋetik ‘to type’
  - /moŋ-ʔomunŋ/ > moŋkomunŋ ‘to bring’
  - /moŋ-ʔai/ > moŋkai ‘to call’

- Is [ŋk] a single segment?
  - The reduplication form of [moŋkomunŋ] is [moŋkomunŋ-комун] ‘carry and carry’, so [ŋk] is heterosyllabic.
  - Other words in Pendau suggest that NC sequence in either initial position or medial position is heterosyllabic.
Opacity issue #2: /ŋʔ/ > [ŋk]

- Assuming [ŋk] is heterosyllabic:
- Assimilation is progressive (/ŋʔ/ > [ŋk], *Nʔ, *N), and this is forced by structure preservation (Kiparsky 1985): HavePlace[nasal].
- Problems with canonical OT: The constraint ranking established earlier would select [ŋ] as the output.

<table>
<thead>
<tr>
<th>/moŋ₁ʔai/</th>
<th>NASASSIM</th>
<th>HAVEPLACE[NASAL]</th>
<th>IDENTPLACEON</th>
<th>*CC</th>
<th>UNIF</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. moŋ₁ai</td>
<td></td>
<td></td>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. moŋ₁kai</td>
<td></td>
<td></td>
<td>*</td>
<td>*!</td>
<td></td>
</tr>
<tr>
<td>c. moN₁ai</td>
<td></td>
<td></td>
<td>*!</td>
<td></td>
<td></td>
</tr>
<tr>
<td>d. moN₁ʔai</td>
<td></td>
<td></td>
<td>*!</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. moŋ₁ʔai</td>
<td></td>
<td></td>
<td>*!</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- [ŋk] suggests the combined violation of the faithfulness constraints IdentPlaceOnset and Uniformity is more severe.
Opacity issue #2: /ŋʔ/ > [ŋk]

- Local Constraint Conjunction (Smolensky 1995):
  - *The Local Conjunction of $C_1$ and $C_2$ in domain $D$:*
    - $C_1$&$C_2$ is violated when there is some $D$ in which both $C_1$ and $C_2$ are violated.

- In this case, the two critical constraints to be conjoined here are Uniformity and IdentPlaceOnset, both of which are faithfulness constraints and impose phonological requirement on the same segment.

<table>
<thead>
<tr>
<th>/moŋ$_1$-ʔ$_2$ai /</th>
<th>IDENTPLACEON &amp; UNIF</th>
<th>IDENTPLACEON</th>
<th>*CC</th>
<th>UNIF</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. moŋ$_{12}$ai</td>
<td>*!</td>
<td>*</td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>b. moŋ$_1$k$_2$ai</td>
<td></td>
<td>*</td>
<td></td>
<td>*</td>
</tr>
</tbody>
</table>
Opacity issue #2: /ŋʔ/ > [ŋk]

- Synchronic chain shift and Local Constraint Conjunction
- Kirchner(1996): only an enriched theory of faithfulness can account for the chain shift mappings in OT.
- For example, Western Basque Hiatus Raising:
  - [a] raised to [e],[e] raised to [i], but [a] did not raise to [i].
  - [a] to [i] is a violation of two faithfulness constraints

```
  a
  ↓
  x
  ↓
  e
  ↓
  i
```

Western Basque Hiatus Raising

Violates IDENT[low]

Violates IDENT[high]

Violates IDENT[low] & IDENT[high]
**Contrast Preservation(?)**

- **Minimization of input-output distance**
  - The optimal candidate is the one that violates the fewest faithfulness constraints.
  - For example,
    - [moŋkai], the output, violates IdentPlaceOnset, which is forced by undominated structure preservation constraint HavePlace[nasal].
    - *moŋai*, with nasal substituion, violates both IdentPlaceOnset as well as Uniformity.
    - This is true not just for the chain shift, but other alternations in Pendau.

- **Maximization of output contrasts**

<table>
<thead>
<tr>
<th></th>
<th>Inputs</th>
<th>Outputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>NT</td>
<td>ṃp</td>
<td>m</td>
</tr>
<tr>
<td></td>
<td>ṃt</td>
<td>ṃ</td>
</tr>
<tr>
<td></td>
<td>ṃk</td>
<td>ṃ</td>
</tr>
<tr>
<td>N?</td>
<td>ṃʔ</td>
<td>ŋk</td>
</tr>
<tr>
<td></td>
<td>*ŋ</td>
<td>*ŋ</td>
</tr>
</tbody>
</table>

  - Neutralization is avoided.
  - Contrasts in the inputs are transferred to the contrasts in the outputs, by means of limiting faithfulness violations.
  - Input onsets are probably highly recoverable.
    - There is unambiguous inversion, as the inputs/outputs at the prefix-root boundaries have one-to-one correspondence.
Conclusion

• Opacity #1:
  o Two fricatives
    • /s/: nasal assimilation; preservation of underlying continuancy
    • /ʃ/: nasal-obstruent coalescence; *[Son, Pal] >> Ident[cont]

• Opacity #2:
  o Local Constraint Conjunction of two faithfulness constraints
  o Minimization of input-output mapping
  o Maximization of output contrasts

• Two sources that drive nasal substitution.
  o In cases of /ŋp/, /ŋt/, /ŋk/ across prefix-root boundaries:
    • *CC forces the violation of Uniformity.
  o In cases of /ŋʃ/ across such boundaries:
    • Uniformity is not forced by *CC, but by the undominated *[Son, Pal].
Thank you.
Selected References


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